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OIL/FAT COMPOSITION FOR FRIED FOOD USE
[Agemonoyo Yushi Soseibutsu]

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[Claims] /*

[Claim 1] An oil/fat composition for fried food use comprising an edible oil or an edible oil to which is added an edible emulsifying agent, said composition being so prepared that the interfacial tension at 80 °C between said composition and water becomes from 10 to 30 mN/m 5 seconds after the formation of the interface.

[Claim 2] The oil/fat composition for fried food use stated in Claim 1, wherein an organic acid monoglyceride, at the least, is used as the edible emulsifying agent.

[Claim 3] The oil/fat composition for fried food use stated in Claim 2, wherein the organic acid monoglyceride is citric acid monoglyceride.

[Detailed Description of the Invention]

[0001] [Field of Industrial Application]

The present invention pertains to an oil/fat composition used for preparing fried food, such as fries, tempura, and so forth. More specifically, the present invention pertains to an improved oil/fat composition for fried food use that, in cooking fries and tempura, makes it possible to more economically prepare fried food that has excellent appearance, flavor, texture, and the like without requiring special skill and that makes it possible to maintain this good

* Claim and paragraph numbers correspond to the original text.

appearance, flavor, texture, and the like even with the passage of a given time after the food is fried.

[0002] [Related Art]

For cooking fried food, such as fries, tempura, and the like, various liquid oils and fats, including rapeseed oil, sesame oil, soybean oil, corn oil, safflower oil, olive oil, rice bran oil, cottonseed oil, sunflower oil, and the like, have been used heretofore for industrial and household use. With the exception of sesame oil and olive oil, which are used for flavor enhancement, these liquid oils and fats that are widely used in today's diet are highly refined oils and fats from which nearly all the components other than triglycerides have been eliminated. These oils and fats retain little of their distinctive flavors derived from their raw materials but are characterized by their versatility for all styles of cooking with oil owing to their plain flavor.

[0003] Fries and tempura are characterized by the coating of ingredients with a batter that is prepared by dissolving flour, starch, etc., in water or the like, as necessary, and by the frying of these coated ingredients in oil. These fried foods are required to have good appearance, flavor, texture, and the like overall. With respect to the "appearance," fried food should be obviously in a crisp condition and should not look oily. For tempura, in particular, the batter should be spread with a proper balance, creating a moderately scattered state (what is called "blooming".) As for the "flavor," it is required, for

example, that the ingredients retain their flavor owing to the batter's enveloping them, that the aroma that is brought about by the heating of a batter with oil enhance the flavor of the fried food as a whole; and that, when eaten, the fried food taste non-oily and have what is called a light flavor. With regard to the "texture," it is required that the inherent juiciness of the ingredient be maintained beneath the crisp batter and that the batter, in particular, be neither too hard nor too mushy and crumble crisply when bitten with teeth, that is to say, that it have "teeth brittleness [as transliterated]." "Delicious" fried food is considered to be fried food that meets all of these requirements. It is desirable that these requirements be met not only immediately after the food is fried but also even after the passage of time.

[0004] To offer "delicious" fried food, stores specializing in fried food--for example, tempura specialty shops--make unique selections with respect to various conditions, including the method for preparing the batter to be used, the type and mixing ratio of oils/fats, and frying temperature, duration, and procedures, and such conditions are the basis for the traditional taste unique to each store. For instance, in order to inhibit the gluten formation from flour, the batter should be prepared with cold water and without excess stirring, and, in order to maintain the temperature of the frying oil at a proper level (which is said to be usually at 180 °C) and not to cause the temperature to drop, food should be fried a small

quantity at a time in plenty of oil. These are some key points for preparing delicious fried food. Putting these points in practice with good reproducibility requires highly trained skill. Further, even the use of plenty of oil, which is a seemingly simple procedure, is difficult to put to practice for the food-processing companies and eateries, which need to provide fried food in large quantities and at low cost, much more difficult for common households, because it means a higher cost, including the cost for waste oil disposal.

[0005] For business use in the food-processing and eatery industries and also for household use, there has been a need for a technology that makes it possible for anyone to prepare "delicious" fried food easily without mistakes, without requiring highly trained skill or the specialized knowledge of specialty shops. For business use, in particular, "delicious" is not the only requirement, and efficient workability and economic efficiency are also required. For instance, the amount of fried batter residues resulting from the separation of part of the batter from the ingredient should be small, and a large volume of products should be fried at a lower temperature within a shorter time so as to prolong the life of the frying oil. In addition, it is also required that fried food should retain its freshly cooked condition even after the passage of time. As the means to meet these challenges, there have been developed and proposed techniques that focus on the "batter" or "oil" among the constituent elements of fried food. With respect to the "batter," various types of

products have been made commercially available as what are called premixed flours for fried food use.

[0006] With respect to the development of oil exclusively used for cooking fried food, in JP-A-H06-113742 is proposed an oil that is a blend of spice extracts, such as a rosemary extract and the like, monoglyceride, diglyceride, and organic acid monoglyceride in a specific ratio. The objective of this invention is to provide an oil/fat composition for fried food use that makes it possible to produce fried food without losing the inherent flavor of the ingredient when used for frying food and that does not degrade much and, consequently, can be used for a long period.

[0007] In JP-A-H07-16052 is proposed an oil/fat composition for fried food preparation use that is comprised of a liquid oil/fat and an emulsifying agent and that is obtained by adding and dissolving the emulsifying agent in a quantity that is 4.0 % by weight or less of said liquid oil/fat, said emulsifying agent being selected so that the interfacial tension at 80 °C between said oil/fat composition and water becomes 7 mN/m or less three seconds after the formation of the interface. The objective of this invention is to provide a composition for fried food preparation use that is improved so as to make it possible to prepare fried food having an excellent appearance, flavor, texture, and so forth, without requiring any skill in using it.

[0008] These compositions both intend to provide oil that makes it possible to produce fried food having excellent appearance, flavor,

texture, and so forth, but they do not take into consideration whether or not the thus-obtained fried food proper can sustain its flavor, texture, etc., even after the passage of a given time.

[0009] The composition disclosed in JP-A-H07-16052 improves the blooming (scattering) of the batter when used especially for cooking tempura, and, from this scattered batter, a large amount of "batter residues" is formed. This phenomenon cannot be ameliorated even if the temperature of the oil is set lower than 180 °C, which is the ideal temperature for cooking tempura. Furthermore, when this composition is used in combination with premixed flour for tempura use, which is intended to be used with ordinary salad oil or the like, the batter scatters excessively, thus causing not only the "batter residues" to increase but also the tempura coating to be very thin and look unattractive. In addition, in proportion to the improvement of the water elimination from the batter (the evaporation of moisture), the transition of the oil into the batter increases; as a result, the obtained tempura has a crispy texture originally, but, once it is cooled after a while, its oiliness becomes prominent.

[0010] [Problems that the Invention Intends to Solve]

The present invention intends to provide an oil/fat for fried food use that makes it possible for anyone to prepare "delicious" fried food, such as fries, tempura, and the like, that is well balanced in appearance, flavor, and texture easily and without failure, without requiring special skills or professional knowledge. It also

intends to provide an oil/fat for fried food use that, especially in cooking tempura, makes it possible to produce tempura that retains a delicious taste even after the passage of a given time, that achieves a good balance between water elimination and oil absorption so that the resulting tempura does not look oily, and that does not generate too much batter residue and, consequently, does not degrade much. Further, it intends to provide an oil/fat for fried food use that, even when it is used in combination with commercially available premixed flour products for tempura use, premixed powder products for karaage [translator's note: a type of deep frying] use, and the like, does not cause the batter to scatter excessively or the resulting food to have intense oiliness.

[0011] [Means For Solving The Problems]

The present inventors conducted extensive research to achieve the aforesaid objectives and, as a result, learned that, when an edible oil that is so prepared as to set its interfacial tension to a value within a certain range or an oil/fat for fried food use comprised of a common edible oil to which is added a proper amount of an emulsifying agent so as to meet the aforesaid condition is used to cook tempura or fries, not only "delicious" fried food that has a good balance between appearance, flavor, and texture can be prepared easily and without failure, but also this "deliciousness" is not lost even after the passage of a given time; the resulting food is not oily owing to a good balance between water elimination and oil absorption, and the

generation of excess batter residues does not occur. They further learned that its combined use with commercially available premixed flour products for tempura use, karaage-use powder, and so forth does not cause a batter to scatter excessively or does not intensify oiliness and makes it possible for anyone to cook tempura easily and without failure.

[0012] The present invention pertains to an oil/fat composition for fried food use comprising an edible oil or an edible oil to which is added an edible emulsifying agent, said composition being so prepared that the interfacial tension at 80 °C between said composition and water becomes from 10 to 30 mN/m 5 seconds after the formation of the interface.

[0013] In frying tempura, the use of an oil/fat composition that is prepared by adding an emulsifying agent, such as citric acid monoglyceride or the like, to a common edible oil so as to set its interfacial tension to a value within a given range improves water elimination and also achieves a proper degree of oil absorption, compared with the case of using oil to which no emulsifying agent is added, and, even after the passage of a given time, the texture stays in relatively good condition. On the other hand, if a composition having a high interfacial tension is used to fry food under the same conditions, water elimination from the batter is insufficient, and, as a consequence, the resulting fried food becomes limp after a while due to too much moisture in the batter. If too much of an emulsifying

agent is added, causing the interfacial tension of the resulting oil/fat composition to become excessively low, the obtained tempura is crisp and tastes good immediately after the frying, but its batter coating becomes hard with time.

[0014] It is believed that delicious tempura that has a batter coating that is fluffy as a whole but still crispy can be produced when the following conditions are met during the process of frying tempura in oil: inside the water-dissolved batter, the starch is gelatinized, the protein is denatured to a proper degree, and the moisture and oil are present in proper amounts. When the interfacial tension of the frying oil is too low, water elimination is too quick, and, consequently, the batter coating has a pointed acicular shape and is not fluffy, and the resulting tempura tastes good immediately after it is fried, with its crisp texture, owing to its low moisture content, but its texture becomes very hard with time.

[0015] If the interfacial tension of an oil/fat drops more than necessary, the affinity with water increases excessively. When the interfacial tension of an oil/fat is an excessively low level of from 3 to 4 mN/m or thereabouts, the moisture in the fried batter is low and, therefore, becomes hard with time. In either case, when the interfacial tension is out of a given range, the texture becomes undesirable with time.

[0016] When tempura is fried with an oil/fat composition to which an emulsifying agent is added to decrease its interfacial tension, the

batter exhibits a tendency to form small droplets so as to make the area of the surface in contact with the oil as large as possible. Furthermore, as a result of this, the heat-transfer speed from the oil is increased, and water evaporates more quickly. Consequently, part of the batter separates from tempura and forms fried batter residues, and the batter remaining on the tempura ingredient is in an acicular form and thin. The amount of generated fried batter residues also increases, thereby requiring a time-consuming operation of eliminating them and also reducing the product yield; thus, the use of this type of composition is not economical. Although the water elimination efficiency is good, the oil absorption increases in turn. Because freshly fried tempura has a good texture, the tempura does not feel oily, but its oiliness becomes extremely noticeable after a while when it becomes cold. In addition, the frying oil decreases quickly, which is not economical. When it is used in combination with a premixed tempura flour product, whose water elimination property is improved by, for example, the addition of an emulsifying agent, the blooming of a batter becomes excessive owing to their synergistic effect, making it difficult for the batter to attach to the tempura ingredient, and the resulting product is unattractive.

[0017] "Agedama" [Translator's note: essentially the same as fried batter residues, but it is made to be sold as a product], which is used as an ingredient for Japanese wheat and buckwheat noodle dishes called "tanuki udon/soba" and so forth, is preferred to have a

spherical and fluffy shape. In the case of producing agedama, adding a proper amount of an emulsifying agent, such as citric acid monoglyceride or the like, to a common edible oil so as to set its interfacial tension to a value within a given range increases the water elimination speed, compared with an oil to which no emulsifying agent is added; as a result, a product having a good shape and texture can be obtained with a shorter frying time or at a lower frying temperature. Consequently, the degradation of the frying oil for producing a unit quantity of products decreases, and the amount of the waste oil also decreases, thus rendering the production more economical. When the interfacial tension is excessively low, fried batter residues are created in a large quantity, and the obtained agedama has a small and poor shape, thereby reducing the commercial value.

[0018] When cooking fried food other than tempura and agedama, the oil/fat composition of the present invention also makes it possible to obtain fried food having a relatively good texture. Further, referring to the production of frozen tempura products, it is a common practice in the food processing industry to fry tempura twice, that is, both before and after the freezing, for the purpose of realizing "deliciousness" more conveniently. The objective of the first frying conducted before the freezing is to solidify the batter, which makes up the outer shape of the product. At this stage, it is not necessary to heat through the inside ingredient as long as the exterior batter is shaped to a certain extent and as long as, at the

second frying stage, the inside ingredient is defrosted and also heated through and the batter is formed into the final state. Therefore, the use of the oil/fat composition of the present invention, to which is added an emulsifying agent to set its interfacial tension to a value within a given range, for the first frying of frozen tempura products makes it possible to process them economically because, as in the case of agedama production, the water elimination speed is increased while the good outer shape is formed. Furthermore, for the same reason, the application of the oil/fat composition of the present invention to Kakiage [translator's note: fries of mixed ingredients], fried squid snack, fried tofu, and so forth can make their production processes more economical.

[0019] The present invention pertains to an oil/fat composition for fried food preparation use that is obtained by controlling the method of preparing--for instance, refining--an edible oil or that is obtained by adding an emulsifying agent to an ordinary edible oil and dissolving it in the oil, said oil/fat composition being characterized by the fact that the preparation of an edible oil or the addition of an emulsifying agent to an edible oil is implemented in such a manner that the interfacial tension at 80 °C between said composition and water becomes from 10 to 30 mN/m 5 seconds after the formation of the interface.

[0020] Edible oils are prepared through extraction/refining processes from oil/fat raw materials, such as soybean, rapeseed, corn,

olive, sesame seed, safflower, cottonseed, sunflower, coconut, palm, and the like. Because the extracted crude oils contain many impurities besides triglycerides, they are subsequently subjected, according to the application, to an appropriate combination of various treatments, including washing with water (for elimination of water-soluble components), degumming (for elimination of gum substances, such as lecithin and the like), deacidification (for elimination of free fatty acids), decoloring (for elimination of pigment components), deodorizing (for elimination of volatile odorous components), and so forth, thereby refining them for human consumption. This series of steps is carried out to process a crude oil that is not suitable for edible use from the standpoint of flavor or the like to an oil suitable for edible use. Edible oils that are widely used are oils/fats that have been highly refined and from which nearly all the components other than triglycerides have been eliminated.

[0021] The interfacial tension of highly-refined edible oils that are usually sold under the name of salad oil is 35 mN/m or thereabouts, as measured by the method used in the present invention, and oils and fats that have a low degree of refining and contain a large amount of impurities besides triglycerides have a lower level of interfacial tension. Some fats and oils--for instance, sesame oil--are intentionally provided for edible use with a low degree of refining for the purpose of making full use of the flavor of the raw material, and, in some cases, these fats and oils as is may have their

interfacial tensions within the range specified in the present invention. The use of an oil in this condition can yield the desired effects. Furthermore, the desired effects can also be obtained by adding an emulsifying agent to an edible oil having a high interfacial tension, like salad oils, thereby decreasing the interfacial tension to the range specified in the present invention. Accordingly, the desired effects can be obtained by either of the following methods: a method of adjusting the degree of refining of an edible oil while ensuring that its flavor is kept and a method of adding an emulsifying agent to an edible oil that is highly refined and has a high interfacial tension.

[0022] Adjusting the interfacial tension of oils and fats to the range specified by the present invention, that is, to be from 10 to 30 mN/m, yields the following advantages (see Table 1).

(1) In frying tempura, an interfacial tension in the specified range leads to a better balance between water elimination and oil absorption, compared with a higher or excessively lower interfacial tension; as a result, the appearance, flavor, and texture of the freshly fried tempura improve, and these stay in good condition even after the passage of a given time. A higher interfacial tension does not cause the tempura coating to become hard with time, but the coating becomes limp due to insufficient elimination of moisture. On the other hand, an oil/fat having an excessively low interfacial

tension produces tempura that is good immediately after it is fried, but the coating becomes hard with time.

(2) Because the affinity between water and oil is in a proper state, water elimination takes place more quickly, compared with the case of using an oil/fat having a higher interfacial tension, and, unlike the case of using an oil/fat having an excessively low interfacial tension, little fried batter residue is generated; as a result, the batter puffs up to a proper degree into a fluffy state and fries crisp.

(3) When producing agedama, agedama having a spherical and fluffy shape can be obtained, as in the case of using an oil/fat having a higher interfacial tension, and, unlike the case of using an oil/fat having an excessively low interfacial tension, the scattering of the batter in an acicular shape does not occur. Furthermore, compared with the case of using an oil/fat having a higher interfacial tension, the frying time can be shortened if the frying temperature is the same, thereby improving the working efficiency. By frying at a lower temperature even for the same frying time, comparable products can be produced; as a consequence, the degradation of the frying oil for producing a unit quantity of products decreases, and the quantity of waste oil also decreases. Further, the composition of the present invention is widely applicable to food industry use, including the mass production of frozen tempura, fried squid snacks, and fried tofu.

(4) Compared with an oil/fat to which a large amount of emulsifying agent is added so as to decrease the interfacial tension to an excessive degree, the coloring of the composition of the present invention with the emulsifying agent is negligible and does not pose any problem.

(5) Compared with an edible oil having a high interfacial tension, the composition of the present invention causes very little oil spattering when used for frying food.

[0023] It is desirable for the aforesaid interfacial tension to reach the range of from 10 mN/m to 30 mN/m within five seconds after the formation of the interface. Incidentally, the standard temperature for measuring the aforesaid interfacial tension is set to 80 °C because, when the ingredient (the object to be cooked) of fried food, such as tempura, etc., is put in a heated oil, the temperature in the vicinity of the interface between the ingredient (including the batter) and the oil becomes about 80 °C.

[0024] [Table 1]

	(a)	(e)	(f)		(i)	(j)		(m)
	乳化剤	界面張力	天ぷらの食感		天ぷらの	揚げ玉		揚げ
		mN/m	揚げたて(g)	4時間後(h)	揚げカス	揚げ効率(k)	品質(l)	着色
(b)	無添加	35	◎△	×(h)	○	×(k)	○(l)	○
(c)	本発明	10~30	○~◎	○	○	○	◎	○
(d)	過剰添加	7以下(n)	◎	×	×	◎	×	×

Key: a) emulsifying agent; b) no addition; c) present invention; d) excess addition; e) interfacial tension; f) texture of tempura batter coating; g) immediately after frying; h) four hours later; i) tempura batter residues; j) agedama; k) frying efficiency; l) quality; m) coloring of oil; n) 7 or less.

Texture of the batter coating: ⊙ very good, ○ good, △ somewhat poor, and X poor (too soft or too hard).

Tempura batter residues: Repeated frying produced ⊙ a moderate amount, X too much.

Agedama frying efficiency: The speed for frying agedama was ⊙ fast, ○ moderately fast, X slow.

Agedama quality: ⊙ spherical, fluffy, and crisp texture.

○ spherical and fluffy but not quite crisp.

X crisp but in an acicular shape and could not form a spherical shape.

Coloring of oil: Repeated frying caused ○ little coloring, X coloring.

[0025] The emulsifying agent that can be used in the present invention is not limited, and examples of preferably used emulsifying agents include glycerides (monoglycerides, diglycerides, polyglycerides, organic acid monoglycerides, and so forth), sorbitan fatty acid esters, sucrose fatty acid esters, and propylene glycol fatty acid esters. Among these, organic acid monoglycerides, better yet, citric acid monoglyceride, are more suitable from the standpoint of the solubility in oil and stability at high temperatures.

[0026] In selecting the emulsifying agent of the present invention, an HLB value (an index for expressing the balance between hydrophobicity and hydrophilicity) of from 2 to 12 is used as a guide.

An emulsifying agent having an HLB that is higher than this range does not dissolve well in oil and tends to cause turbidity, sediment, or settling. If the HLB is lower than this range, the emulsifying agent must be added in a large quantity in order to obtain a desired interfacial tension; as a result, the taste of the emulsifying agent becomes obtrusive and affects the flavor adversely.

[0027] The interfacial tension specified in the present invention means the dynamic interfacial tension defined in JP-A-H07-16052. This dynamic interfacial tension can be measured with a stalagmometer (a product of Kaburagi Kagaku Co.) that complies with JIS K3304-1956 "Soap Test Method" described in Shin Jikken Kagaku Koza 18: Interface And Colloid, edited by the Chemical Society of Japan, pp. 87-91, **1983**, third edition, published by Maruzen Co. In addition, the dynamic interfacial tension specified in the present invention can be measured with a commercially available interfacial tension measuring apparatus (a Drop Volume Tensiometer TVT1, a product of Louda Co. in Germany, which utilizes a drop weight method.) The specifics of the measuring method will be given later.

[0028] The oil/fat composition of the present invention intended for fried food preparation use is obtained by controlling the refining process of an edible oil or by adding an emulsifying agent to an edible oil/fat in such a manner that the resulting edible oil or edible oil/fat has a specific interfacial tension. The oil/fat used here can be selected from various kinds of oils that are generally

considered to be usable as a frying oil for tempura and the like. Some examples thereof include vegetable oils, such as soybean oil, rapeseed oil, corn oil, safflower oil, sunflower oil, cottonseed oil, olive oil, sesame oil, fractionated palm olein, and so forth, and animal oils. These oils may be used singly or mixed as appropriate and used. Furthermore, they may be subjected to such structural modification as interesterification, hydrogenation, or the like and used.

[0029] [Working Examples]

The details of the invention in the present application will be described, referring to working examples. The invention of the present application is not restricted by these working examples.

[0030] The interfacial tension used in the working examples presented herein was measured by the following method.

Method for measuring interfacial tension

A specified U-shaped tube that contains a sample oil is placed in a vertical position inside an 80 °C water bath. A stalagmometer that is filled with 80 °C distilled water is inserted into the tube so as to place its tip portion at about 3 cm from the oil surface and secured in a vertical position. The dropping speed of water droplets from the stalagmometer is adjusted to 12 ± 2 droplets per minute, and the number of droplets formed while 5 cc distilled water inside the stalagmometer descends (from the upper gauge line to the lower gauge line of the stalagmometer) is determined. The temperature of the water bath is regulated to 80 ± 0.2 C°. The value of the interfacial tension

(γ) can be found by the following equation from the radius (r) of the tube of the stalagmometer, the volume (V) of one drop of the dropped distilled water, the density difference (ρ) between the sample oil and distilled water, the correction factor (ψ) (Kagaku Benran, Kisohen, edited by the Chemical Society of Japan, second revision, 7, Interfacial Phenomenon), and the gravitational constant (g).

$$\gamma = (V\rho g)/\{2\pi r\psi(r/V^{1/3})\}$$

Incidentally, the interfacial tension in the present invention is defined as the interfacial tension measured "five seconds after the formation of the interface" because, in accordance with JIS K3304-1956 "Soap Test Method," the falling speed of water droplets from the stalagmometer is set to 12 droplets per minute, that is, one droplet per 5 seconds.

[0031] Working Example 1

A sweet potato tempura test was carried out as follows.

(1) Method for preparing the tempura

Tempura batter: weak wheat flower 100 + egg 50 + cold water 100

Frying conditions: six slices of sweet potatoes, each slice being cut 4 cm square and 0.4 cm thick, that were coated with the aforesaid batter were fried in 500 g frying oil at 180 °C for 1.5 minute.

(2) Tempura evaluation method

A panel of 10 specialists tasted the samples and assigned points to the samples on the following evaluation items, and the evaluation result of each item was expressed by the average of these points. The

texture of freshly cooked tempura that was fried in an ideal condition, that is, with plenty of oil for food to be fried (one slice of sweet potato per 500 g oil) so as to cause little decrease in the oil temperature, was assumed to correspond to the perfect score of a 5-point scale, and, using this as the standard, the samples were evaluated. The results are shown in Table 2.

[0032] [Table 2]

(a) 添加量 (%)	(b) 界面張力 (mN/m)	(c)天ぷらの食感 揚げ直後 (d) (j)	4 h後 (e)	(f)天ぷらの硬さ 揚げ直後 (d) (kgf)	4 h後 (e)	(g)天ぷら 水分 (%) (h)	油分 (%) (i)
0	35.0	3.4△	2.1×	1.1	1.8	49.8	18.2
0.03	30.3	4.0○	3.0△	1.6	2.1	48.1	18.7
0.05	27.4	4.1○	3.7○	1.8	2.4	47.0	19.0
0.1	15.3	4.4◎	4.1○	2.2	3.5	45.8	19.8
0.15	10.4	4.5◎	4.0○	2.6	4.0	43.9	21.1
0.2	7.1	4.5◎	3.4△	3.0	4.8	42.3	23.4
0.3	3.0	4.7◎	2.7×	3.7	6.2	39.7	25.7
0.5	1.1	4.6◎	2.0×	4.2	7.4	37.1	29.4

Key: a) added amount; b) interfacial tension; c) texture of tempura batter coating; d) immediately after frying; e) 4 hours later; f) hardness of tempura batter coating; g) tempura batter coating; h) water content; i) oil content; j) (points, evaluation).

The emulsifier used: citric acid monoglyceride (Sun Soft 623M, a product of Taiyo Kagaku Co.)

Standard (a freshly fried sweet potato sample in a specified size that was fried one piece at a time): hardness 3.2 kgf, water content 46.9 g, oil content 19.2 %.

Measurement of hardness of tempura batter coating: measured with a tensipressor (a product of Taketomo Co.)

Scores : 5-point scale evaluation

5: crisp and very delicious

4: crisp and good

3: moderately crisp

2: hard or moist and mushy

1: very hard or moist and very mushy

Evaluation: ⊙ excellent, ○ good, △ somewhat poor, X poor (too soft or too hard).

Method for measuring the water content and oil content of tempura batter coating

Water content: the weight that was lost at 105 °C for 4 hours.

Oil content: the weight of an ether extract from the dehydrated sample with a Soxhlet extractor.

[0033] As seen in the foregoing, compared with "delicious tempura," which was fried with plenty of oil, the samples fried with oils having a low interfacial tension had a good texture that was comparable to the standard when it was still fresh, but it became very hard and tasted oily four hours later. A higher interfacial tension caused the batter to retain more moisture, and the tempura coating became limp. In contrast to these, the samples fried in oils having an interfacial tension of from 10 to 30 mN/m not only received high scores immediately after they were fried but also showed no extreme change in their texture and hardness even after the passage of 4 hours.

[0034] Working Example 2

An agedama frying test was conducted as follows.

(1) Agedama preparation method

A tempura batter (Showa Tempura premixed flour + addition of 160 % water) was prepared. A given amount (approximately 20 ml) was taken with a holed ladle and dribbled into a heated frying oil (500 g oil), after which the batter was fried at a given temperature for a given time.

(2) Agedama evaluation method

It is preferable for agedama to be in a proper size, to puff up into a fluffy spherical shape, and to be palatable (have a good texture). Considering its use for Japanese wheat noodle and buckwheat noodle dishes, agedama that can sustain its shape and proper texture when it is put into hot water is considered to be a better product.

Shape: visual observation

Texture: Organoleptic test by a panel of (10) specialists (evaluated with a 5-point scale, a larger number indicates a better result.)

Measurement of (1) the time required for reaching a given moisture content at a given frying temperature (water elimination speed) and of (2) the temperature required for reaching a given moisture content with a given frying time:

They were found by frying agedama at various temperatures and for various lengths of time and plotting the relationship between its water content and time or temperature into a graph. The results are shown in Table 3.

[0035] [Table 3]

	(a)	(b) (%)	(c)	(d) (e)	(f)	(g)	(h)	(i) (s)	(℃)
(j)		0	25.0	(l)	3.5	(p)	△	1.0	170
(j)		0.03	30.3	(l)	3.7	(p)	△	0.8	165
(j)		0.05	27.4	(l)	4.2	(p)	△	0.9	165
(j)		0.1	15.3	(m)	3.6	(p)	△	0.7	155
(j)		0.15	10.4	(m)	3.5	(q)	○	0.7	155
(j)		0.2	7.1	(n)	3.4	(q)	△	0.7	150-155
(j)		0.3	2.0	(o)	4.0	(r)	×	0.6	150
(j)		0.5	1.1	(o)	4.2	(r)	×	0.4	140
	PGPR	1.0	15.0	(m)	3.4	(p)	△	0.7	155
(k)		0.5	7.5	(o)	4.8	(q)	△	0.8	160
(k)		1.0	3.2	(o)	4.2	(r)	×	0.6	150

Key: a) emulsifying agent; b) added amount; c) interfacial tension; d) evaluation of agedama (fried at 170 °C for 1 minute); e) shape; f) texture (score); g) shape in hot water; h) overall evaluation; i) time (in minutes) (when fried at 170 °C) and temperature (when fried for 1 minute) required to reach a water content of 2 %; j) citric acid MG; k) polygly E; l) spherical; m) almost spherical; n) ellipsoidal; o) acicular, fine pieces; p) retained; q) nearly retained; r) broken up; s) minutes.

Citric acid MG: citric acid monoglyceride.

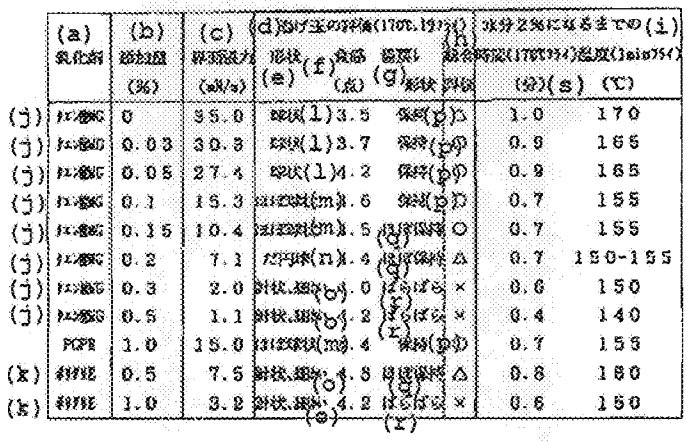
Polygly E: polyglycerol ester of fatty acid (Sun soft 175S, a product of Taiyo Kagaku Co.)

PGPR: polyglycerol ester of polyricinoleic acid (Poem PR-300, a product of Riken Vitamin Co.)

Overall evaluation: ○ good, △ somewhat poor, X poor.

[0036] The compositions having a low interfacial tension exhibited the effects of shortening the required frying time and of decreasing the required frying temperature, but the agedama samples that were fried with them received extremely poor evaluations and were not suitable for actual use. The compositions whose interfacial

[0035] [Table 3]



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Overall evaluation: ○ good, △ somewhat poor, X poor.

[0036] The compositions having a low interfacial tension exhibited the effects of shortening the required frying time and of decreasing the required frying temperature, but the agedama samples that were fried with them received extremely poor evaluations and were not suitable for actual use. The compositions whose interfacial

tension was within the range of from 10 to 30 mN/m, compared with those having a higher interfacial tension, yielded agedama samples that had better texture and also a better shape and also made it possible to prepare agedama within less time or at a lower frying temperature.

[0037] Working Example 3

A sweet potato tempura frying test was carried out as follows. Under the same conditions as those in the sweet potato tempura frying test conducted in Working Example 1, a total of 108 slices of sweet potatoes, six slices at a time, were continuously fried. Then, the obtained samples were evaluated for the following items. The results are shown in Table 4.

Degree of coloring after the frying: Determined by the Lovibond method with a 1-inch cell.

Quantity of generated fried batter residues: Fried batter residues were scooped up from the frying oil and weighed.

Oil decrease rate: The oil was weighed after the frying process, and the rate of decrease from the weight before the frying was found.

[0038] [Table 4]

	(a)	(b)	(c)	(d)	(e)	(f)
	乳化剤	添加量 (%)	界面張力 (mN/m)	フライ油の色相 (Y+R)	揚げカス発生量 (g)	フライ油の減少量 (%)
		0	35.0	7+0.6	15	12.4
(g)	ﾊﾝｶﾞﾘｰMG	0.08	30.3	7+0.7	17	12.8
(g)	ﾊﾝｶﾞﾘｰMG	0.1	15.3	8+0.8	21	13.3
(g)	ﾊﾝｶﾞﾘｰMG	0.15	10.4	8+0.8	23	13.8
(g)	ﾊﾝｶﾞﾘｰMG	0.2	7.1	8+0.8	24	14.0
(g)	ﾊﾝｶﾞﾘｰMG	0.5	1.1	9+0.9	88	20.5
(h)	ｼｭｶﾞｰｴｽﾃﾙ	0.5	2.5	18+1.7	46	16.7
(i)	ポリグリE	0.5	5.8	10+1.0	38	15.1

Key: a) emulsifying agent; b) added amount; c) interfacial tension; d) hue of frying oil; e) amount of generated batter residues; f) loss of frying oil; g) citric MG; h) sugar ester; i) polygly E.

Citric MG: citric acid glyceride.

Sugar ester: sucrose fatty acid ester (0-190, a product of Mitsubishi Kagaku Foods Co.)

Polygly E: polyglycerol ester of fatty acid (Sun soft 175S, a product of Taiyo Kagaku Co.)

Explanation of hue:

Y+R (Lovibond colorimeter), A higher Y value indicates a more yellowish hue, and a higher R value indicates a more reddish hue.

[0039] [Effects of the Invention]

The present invention can provide an oil/fat composition for fried food use that does not require professional skills or special know-how in household use or in food industry applications. The present invention provides an oil/fat for fried food use that, in the preparation of agedama and frozen tempura industrially, makes it possible to obtain high quality products more efficiently and more

economically, compared with oils whose interfacial tension is higher or excessively low. The present invention can also provide an oil/fat for fried food use that creates a good balance between water elimination and oil absorption when it is used for frying tempura, thereby producing fried food that not only has a good texture immediately after the frying but also can retain its good texture even after the passage of a given time. The present invention can provide an oil exclusively for tempura use that enables anyone to fry tempura easily without failure even when it is used in combination with a commercially available premixed tempura flour.